

Chapter 4 FRAPPY!

Scoring Guidelines

Intent of the question The primary goals of this question are to assess a student's ability to: (1) describe how to assign treatments in a completely randomized design; (2) identify a benefit and drawback to using subjects with varied initial symptoms; (3) explain the concept of statistical significance in the context of a randomized experiment; (4) explain how blocking can be incorporated in an experiment.

Model Solution

(a) Label 83 note cards with "A" and 83 note cards with "B." Shuffle the cards well and hand one card out to each subject at random. Subjects with "A" cards will receive the antibiotic and subjects with "B" cards will receive the placebo.

(b) Benefit: We can make inferences about subjects with moderate, severe, or very severe symptoms and not just those with very severe symptoms.

Drawback: Because subjects with very severe symptoms will likely have different test scores than subjects with moderate symptoms, there will be more variability in test scores if subjects with a range of symptoms are included. This will make it more difficult to find convincing evidence that the antibiotic is more effective than a placebo.

(c) If the difference is not statistically significant, then the difference wasn't large enough to rule out random chance as a plausible explanation. That is, the observed difference could be due to the random assignment and not to the effects of the treatments.

(d) To incorporate blocking, form blocks based on the initial conditions of the patients. That is, put all the patients with very severe symptoms into one block and so on. Then within each block, randomly assign the subjects to treatments as in part (a). Blocking by initial severity will help us account for the additional variability in test scores caused by the differences in severity.

Scoring

Parts (a)–(d) are scored essentially correct (E), partially correct (P), or incorrect (I).

Part (a) is scored as follows

Essentially correct (E) if the response describes a method of random assignment that is described in sufficient detail and results in a completely randomized design.

Partially correct (P) if the response describes a method of random assignment that results in a completely randomized design, but does not contain sufficient detail.

Incorrect (I) otherwise.

Notes:

- A response that only says “use a random number generator” or “use a random digit table” to assign the treatments is not sufficiently detailed.
- If a response uses random digits, to have sufficient detail the explanation of method must address what to do with repeated numbers.
- If a response uses a random digit table, the subjects must be identified with labels of the same length (e.g., 001 not 1).
- A response that incorporates blocking is scored Incorrect (I).
- A response that uses coin flipping (or equivalent) and stops assigning subjects to a treatment when the number of subjects reaches 83 must put the subjects in random order initially to result in a completely randomized design. Otherwise, score this type of response Incorrect (I).

Part (b) is scored as follows

Essentially correct (E) if the response identifies the benefit of larger scope of inference and drawback of increased variability in test scores.

Partially correct (P) if the response identifies either the benefit or the drawback, but not both.

Incorrect (I) otherwise.

Note:

- Saying only that there will be “more variability” without specifying that there will be more variability in the response variable (test scores) is not sufficient for the drawback component.

Part (c) is scored as follows

Essentially correct (E) if the response indicates that the difference in average test scores could be due to chance and explains that the chance is due to the random assignment of treatments.

Partially correct (P) if the response only states that the difference in average test scores could be due to chance.

Incorrect (I) otherwise.

Part (d) is scored as follows

Essentially correct (E) if the response describes forming blocks by grouping subjects with similar characteristics (e.g., severity of symptoms) and indicates that the subjects will be randomly assigned to treatments within each block.

Partially correct (P) if the response describes forming blocks by grouping subjects with similar characteristics but does not indicate that the subjects will be randomly assigned to treatments within each block.

Incorrect (I) otherwise.

Notes:

- A response that uses a variable other than severity of symptoms must include a justification for the choice of blocking variable that addresses variability in test scores. If the justification is not included but the response is otherwise correct, score the response partially correct (P).
- In part (d), the random assignment within blocks only needs to be mentioned, not described.
- A response that pairs subjects by severity of symptoms and randomly assigns the members of the pair to the two treatments is essentially correct (E).
- In this context, a response that assigns both treatments to each subject, in random order, should be scored partially correct (P).

Each essentially correct (E) section counts as 1 point. Each partially correct (P) section counts as $\frac{1}{2}$ point. If a response is between two scores (for example, $2\frac{1}{2}$ points), use a holistic approach to decide whether to score up or down, depending on the overall strength of the response and communication, particularly in parts (a) and (d).

4 Complete Response

3 Substantial Response

2 Developing Response

1 Minimal Response